

REMARKS

I. Introduction

By the present Amendment, claims 1, 4-8, 11, and 14-20 have been amended. Claims 3 and 13 have been cancelled, without any prejudice or disclaimer to the subject matter recited therein. Accordingly, claims 1, 2, 4-12, and 14-20 remain pending in the application. Claims 1 and 11 are independent.

II. Office Action Summary

In the Office Action of May 11, 2009, claims 1-13, 16, 17, 19, and 20 were rejected under 35 USC §102(b) as being anticipated by U.S. Patent No. 6,213,947 issued to Phillips. This rejection is respectfully traversed.

III. Allowable Subject Matter

The Examiner's indication that claims 14, 15, and 18 would be allowable, if rewritten in independent form to include all the limitations of the base claim and any intervening claims, is noted with appreciation.

IV. Rejections under 35 USC §102

Claims 1-13, 16, 17, 19, and 20 were rejected under 35 USC §102(b) as being anticipated by Phillips. Regarding this rejection, the Office Action indicates that Phillips discloses an ultrasonic diagnostic apparatus that includes a probe which transmits and receives ultrasonic waves, a transmission means which outputs transmission signals for driving the probe, a reception means which processes reception signals, and an image reconstruction means which reconstructs an ultrasonic image using the reception signals. The Office Action further alleges that the transmission means creates and outputs the transmission signals corresponding

to a composite modulation code sequence, and that the reception means is provided with a demodulator which demodulates the modulation based on the composite modulation code sequence. Regarding claim 3, the Office Action goes on to indicate that Phillips discloses the composite modulation code sequence being composed of a first modulation code sequence and a second modulation code sequence, and two demodulators for respectively demodulating the two code sequences. Applicants respectfully disagree.

By the present Amendment, Applicants have amended independent claim 1 to incorporate the subject matter previously recited in claim 3. As amended, independent claim 1 defines an ultrasonic diagnostic apparatus that comprises:

- a probe which transmits and receives ultrasonic waves to and from an object to be inspected;

- a transmission means which outputs transmission signals for driving the probe;

- a reception means which processes reception signals received by the probe; and

- an image reconstruction means which reconstructs an ultrasonic image using the reception signals outputted by the reception means,

- wherein:

- the transmission means creates and outputs the transmission signals corresponding to a composite modulation code sequence composed from two or more modulation code sequences,

- the reception means is provided with a demodulator which demodulates the modulation based on the composite modulation code sequence for the reception signals,

- the demodulator comprises a first demodulator for demodulating the modulation based on the first modulation code sequence, and

- a second demodulator for demodulating the modulation based on the second modulation code sequence, and the reception signals outputted by the probe are demodulated by one of the first and second demodulators, and then further demodulated by the other demodulator.

The ultrasonic diagnostic apparatus of independent claim 1 includes a probe which transmits and receives ultrasonic waves to and from an object to be inspected, and a transmission means which outputs transmission signals for driving the probe. A reception means processes the signals received by the probe, while an image reconstruction means reconstructs an ultrasonic image using the reception signals output by the reception means. According to independent claim 1, the transmission means creates and outputs the transmission signals corresponding to a composite modulation code sequence composed from two or more modulation code sequences. The reception means includes a demodulator which demodulates the modulation based on the composite modulation code sequence for the reception signals having a first modulation code sequence and a second modulation code sequence. The demodulator includes a first demodulator for demodulating the modulation based on the first modulation code sequence, and a second demodulator for demodulating the modulation based on the second modulation code sequence. The reception signals output by the probe are then demodulated by either the first or second demodulators, and further demodulated by the remaining demodulator.

Phillips discloses a medical diagnostic ultrasonic imaging system wherein first and second ultrasonic beams are launched into the body along two spatially distinct transmit directions and used B-mode or motion detection processing. The two beams are coated with non-linear phase modulation codes and the second beam is launched before the first beam has left the tissue. While Phillips discloses the use of two different modulation codes, the system operates in a manner which differs from that of the claimed invention. Phillips creates and outputs the two modulation code sequences at the same time. During reception, the two modulation code sequences are demodulated by a signal demodulator. While multiple demodulators are used,

there is no disclosure or suggestion for performing the demodulation in a dual-stage manner using the different demodulators.

In contrast, the present invention provides a composite modulation code sequence that is composed from a first modulation code sequence and a second modulation code sequence. Furthermore, the demodulator includes a first demodulator which specifically demodulates the modulation based on the first modulation code sequence, as well as a second demodulator which demodulates the modulation based on the second modulation code sequence. The reception signals are then demodulated by either the first or second demodulators in two different stages. Accordingly, if the reception signals are long with respect to time, the lobe on the time side can be significantly reduced by using two different stages of demodulation. Phillips simply fails to provide any disclosure or suggestion for features recited in independent claim 1, such as:

the reception means is provided with a demodulator which demodulates the modulation based on the composite modulation code sequence for the reception signals,

the demodulator comprises a first demodulator for demodulating the modulation based on the first modulation code sequence, and

a second demodulator for demodulating the modulation based on the second modulation code sequence, and the reception signals outputted by the probe are demodulated by one of the first and second demodulators, and then further demodulated by the other demodulator.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2 and 4-10 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to

independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

As amended, independent claim 11 defines an ultrasonic diagnostic apparatus that comprises:

a probe which transmits and receives ultrasonic waves to and from an object to be inspected;

a transmission means which outputs transmission signals for driving the probe;

a reception means which processes reception signals received by the probe to obtain reception signals of which harmonics are emphasized; and

an image reconstruction means which reconstructs an ultrasonic harmonic image using the reception signals outputted by the reception means,

wherein:

the transmission means creates and outputs the transmission signals corresponding to a composite modulation code sequence composed from two or more modulation code sequences and having phase shift amounts with respect to the fundamental wave as values of code elements,

the reception means is provided with a demodulator which demodulates the modulation based on the composite modulation code sequence for the reception signals,

the composite modulation code sequence is a composite modulation code sequence composed from a first modulation code sequence and a second modulation code sequence,

the reception means has a first demodulator for demodulating the modulation based on the first modulation code sequence for the reception signals, and a second demodulator for demodulating the modulation based on the second modulation code sequence for the reception signals, and

the first and second demodulators have such a configuration that the reception signals should be demodulated by one of the first and second demodulators, and then further demodulated by the other demodulator.

The ultrasonic diagnostic apparatus of independent claim 11 includes various features that are similar to those recited in independent claim 1. For example, the reception means has a first demodulator for demodulating the modulation based on the first modulation code sequence for the reception signals, and a second demodulator for demodulating the modulation based on the second modulation code sequence for the reception signals. Additionally, the first and second demodulators are configured such that the reception signals output by the probe are demodulated by either the first or second demodulators, and further demodulated by the remaining demodulator. As previously discussed, such features are not shown or suggested by the art of record.

It is therefore respectfully submitted that independent claim 11 is allowable over the art of record.

Claims 12 and 14-20 depend from independent claim 11, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 11. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

V. Conclusion

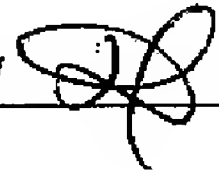
For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 1070.46256X00).

Respectfully submitted,
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